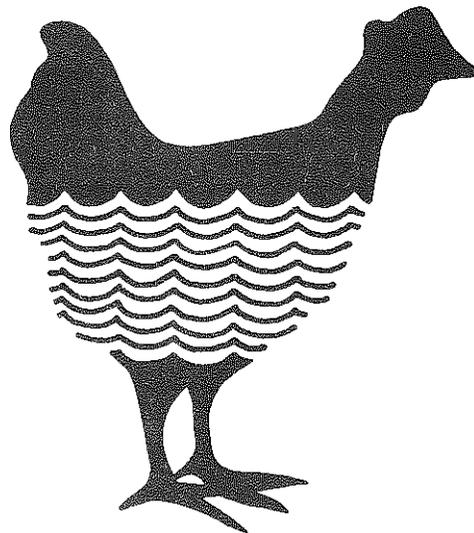


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# A FIVE-YEAR ANALYSIS OF NEW YORK EGG FARM MANAGEMENT FACTORS



D. L. CUNNINGHAM

Department of Poultry & Avian Sciences  
New York State College of Agriculture & Life Sciences  
A Statutory College of the State University  
Cornell University Ithaca, New York 14853

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This publication was first made available in an unnumbered series in October 1981. Due to the economic analysis presented it seemed desirable to add it to the Agricultural Economics Research series so that it could be available to researchers and others concerned with the economic problems of egg production on New York poultry farms.

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## INTRODUCTION

There are many factors which contribute to the success or failure of a commercial egg production farm. Factors such as economic inflation, consumer attitudes and product demand are generally out of the control of the producer. However, there are numerous production and business management practices available to management to improve the income situation of egg production flocks. Management is continuous and decisions must be made daily for many of the management variables. Success in business depends on the ability of the manager to determine and use the most effective combinations of management practices for his particular operation.

In view of the continuing high costs related to egg production such as feed, equipment, labor, housing, energy etc., it is essential that optimum business and production management procedures be identified and practiced to insure satisfactory levels of returns to capital and management. The nature of the egg production industry is such that only the more efficient operations are likely to be profitable ones. Determining the relative importance of various business and production factors as they relate to labor and management incomes should be of value to egg producers.

The definition of a successful poultry operation often depends on the individual owners point of view. To some, it means finishing the year with a positive cash flow. For others, it may mean achieving a certain standard of living or a particular income level, while others may consider net income per bird to be their standard of success. However, the most commonly used measure of success in farm management is labor and management income per operator.

Poultry farm business and production records have been collected and summarized jointly by the Department of Agricultural Economics and the Department of Poultry and Avian Sciences at Cornell University for many years. These data have been summarized and published annually as the Poultry Farm Business Summary, but statistical analysis of the factors utilized in these reports has not previously been done. The purpose of this project was to determine statistically the effect on labor and management income per operator of certain poultry farm business management factors reported in these annual business summaries.

### Methodology

Sixty-one poultry farm business summary records on flocks of laying hens for the period of 1975 through 1979 were utilized in this study. The purpose was to combine business management factors and production management factors into a statistical model to determine the relationship and relative importance of the different factors upon income per operator. Information from records from poultry farms that participated in the poultry farm business summaries during 1975 through 1979 was placed on computer cards. Income information along with pertinent production and business management information was included for each farm. Farms reporting poultry only enterprises were used in this analysis to avoid the effects of crop production and other commodity incomes on the results. Through the use of the Cornell computer facilities, it was possible to sort the data and to perform Pearson correlation and multiple regression analysis for the variables measured.

Seventeen variables were available and used for analysis in this study. Each of the variables when considered independently relates to production performance and income on the farm. However, it is the relative importance of these factors when analyzed in combination with the other variables over a period of time that is of interest. Definitions and abbreviations used for the variables in this study are described below.

### Definitions

Twelve of the 17 variables were considered to be business management factors. The remaining variables were evaluated as production management factors.

Labor and management income per operator (INCOP) - represents the dollar return to the farm operator for his time, knowledge and skills in operating the poultry farm.

Eggs marketed wholesale (WOLSALE) - represents the percentage of eggs marketed through wholesale channels.

Eggs marketed premium (PREM) - represents the percentage of eggs marketed through retail and semi-retail channels.

Price received per dozen (PR/DZ) - is the average price per dozen received by the producer for his product.

Average farm inventory (INVENT) - the average beginning and end of year value of farm assets for the production period.

Investment per hen (INV/HN) - the average farm inventory divided by the average number of hens.

Total labor cost per dozen (LBRCST/DZ) - total expenses for hired and family labor divided by the total number of dozens of eggs marketed.

Total costs per dozen (CST/DZ) - total farm costs including interest on equity capital and a charge for operators labor divided by the total number of dozens of eggs sold.

Net egg income per dozen (NINC/DZ) - the average price received per dozen eggs sold less the average total cost per dozen eggs sold.

Income per hen (INC/HN) - total receipts divided by the average number of hens.

Feed costs per hundred weight (FDCST/CWT) - the average price per 100 pounds of layer feed purchased.

Feed costs per dozen (FDCST/DZ) - total feed expenses divided by the number of dozens of eggs produced.

Pounds of feed per dozen (LBS/DZ) - the total pounds of feed used divided by the total number of dozens of eggs produced.

Number of layers (LAYRS) - the average number of layers for the year.

Birds per cage (BDS/CG) - the number of birds housed per cage.

Square inches per bird (INCH/BD) - the square inches of area provided for each hen.

Eggs per hen (EGS/HN) - the total number of eggs produced divided by the average number of hens.

### Procedures and Statistical Analysis

Data from 61 layer flock records collected during the period of 1975 through 1979 from the poultry farm business summaries were used in this study. Information from "poultry only" enterprise summaries were used. The selected information for analysis was punched on computer cards and a computer program sorted the data into the various categories and computed the average values for each factor.

A Pearson correlation analysis was performed on the selected factors to determine the magnitude of a straight line relationship between variables taken two at a time. The correlation coefficient between x and y is defined as:

$$r_{xy} = \frac{\sum (x-\bar{x}) (y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}}$$

The closer  $r_{xy}$  is to one or minus one, the stronger the correlation indicating a possible cause and effect association.

Additional information regarding the relationship of variables can be obtained by multiple regression of a dependent variable on any number of independent variables simultaneously. The model used for multiple regression is:

$$Y = a + b_1 X_1 + b_2 X_2 + \dots + b_k X_k + e$$

This procedure was applied to the data to determine which independent variables were most important in affecting the dependent variable labor and management income per operator. The multiple correlation coefficient ( $R^2$ ) is used to describe these relationships.

Results of this study may be used for making policy recommendations in New York State, for use by poultry operators to compare their performances with the averages and for demonstrating the basic relationships of poultry management practices to labor and management income per operator.

ANALYSIS OF PRODUCTION VARIABLES

The production variables examined in this study were; average number of layers, eggs produced per hen, birds per cage, area per bird, and pounds of feed per dozen eggs produced. The average values for these variables by years as shown in the business summaries are given in Table 1.

Table 1. Yearly Averages for Production Variables, and Pearson's Correlation Coefficients

Variable	Year					Average	Correlation Coef.
	75	76	77	78	79		
Number of layers	23,839	26,812	34,699	24,987	48,331	32,187	0.19
Eggs per hen	227	219	240	249	236	232	0.25*
Birds per cage	NA	NA	7	5	6	6	-0.13
Area per bird (inch) <sup>2</sup>	NA	NA	60	57	55	57	-0.22
Lbs feed/doz.	4.6	4.8	4.4	4.1	4.0	4.4	-0.49**

\*Significant (P<.05)

\*\*Significant (P<.01)

Flock size during this five-year period for the farms in the summary averaged 32,187 hens. Eggs produced per hen averaged 232 with an upward trend in egg numbers per bird during the latter years. Data on birds per cage and area per bird were not available until 1977. However, a trend toward reduced area per bird from 1977 to 1979 is evident. Increasing investment costs may have resulted in more crowding to reduce per-bird costs. Pounds of feed required to produce a dozen eggs improved significantly over time and averaged 4.4 for the five-year period. The improvement in egg numbers per hen combined with the availability and use of equipment for monitoring feed usage that has gained interest in recent years likely were factors in obtaining better feed usage figures during 1977 to 1979.

Number of layers and selected variables

To offset rising costs and to increase total farm income, poultry operations have increased in size. Increasing the number of layers on a poultry farm effects many aspects of management. Some of the simple relationships found in this study relating to number of layers in the flocks are summarized in Tables 2 and 3.

Table 2. Number of Layers Per Flock as Related to Feed Costs Per Cwt, Pounds of Feed Per Dozen, Feed Costs Per Dozen, and Pearson's Correlation Coefficients

Number of Layers	Percentage of Flocks	Feed Costs Per Cwt.	Feed Per Dozen	Feed Costs Per Dozen
Under 10,000	21.3	\$7.46	4.7 lbs.	34.6¢
10,000 to 29,999	49.2	7.42	4.4	32.3
30,000 to 59,999	18.0	6.96	4.4	29.8
60,000 & over	11.5	6.93	4.2	27.5
Correlation Coef.		-0.19	-0.20	-0.33**

\*\*Significant (P<.01)

Sixty-seven percent of the flocks analyzed fell within the range of 10,000 to 59,999 layers. Only 11.5% were 60,000 layers or greater while 21.3% were under 10,000. A correlation of -.19 was present between layer numbers and feed costs in these flocks. Although statistically nonsignificant (P<.05) this relationship, as shown in Table 2, indicates that as flock size increased, the price paid for feed tended to decrease. A statistically nonsignificant negative relationship of -.20 between layer numbers and feed conversion was also present. As a result of the interrelationship of these two variables with flock size, feed costs per dozen eggs produced was significantly less for the larger flocks. A significant correlation of -.33 was present for flock size and feed cost per dozen. The decreased price of feed for the larger flocks may have been due to reduced rates associated with increased tonage and use of on-the-farm mix mills. The improvement in feed conversion with increasing flock size is not readily explained but may be related to increased bird densities and more efficient mechanical feeding systems in larger units on the larger farms.

Table 3. Number of Layers Per Flocks as Related to Average Farm Inventory, Price Received Per Dozen, Total Costs Per Dozen, Net Egg Income Per Dozen, Income Per Operator, and Pearson's Correlation Coefficients

Number of Layers	Average Farm Inventory		Price Per Dozen	Total Costs/Dozen	Net Egg Income/Dozen	Income/Operator
	Total	Per Hen				
Under 10,000	\$65,822	\$11.85	62.2¢	63.3	-1.1	\$4,138
10,000 to 29,999	195,490	10.41	60.4	58.2	2.2	11,956
30,000 to 59,999	339,352	7.81	60.1	57.5	2.6	20,332
60,000 & over	777,935	6.41	55.4	53.5	1.9	72,733
Correlation Coef.	0.91**	-0.17	-0.31*	-0.30*	0.07	0.72**

\*Significant (P<.05)

\*\*Significant (P<.01)

As would be expected, a highly significant correlation of .91 was observed between flock size and average farm inventory (Table 3). Larger flocks were associated with larger farm inventories. As flock size increased, price received per dozen eggs sold decreased, however, no significant relationships with net egg income per dozen was observed. Income per operator increased as flock size increased. As there was no apparent relationship between net egg income from egg sales and the number of layers the positive association between the number of layers and income per operator was related to other income factors and will be discussed in other sections.

Numbers of eggs per hen and selected variables

Increasing egg production is one of the best methods for improving many of the important production and income performance factors. The relationship of some of these factors with eggs produced per hen are shown in Tables 4 and 5.

Table 4. Number of Eggs Produced Per Hen as Related to Pounds of Feed Per Dozen, Feed Costs Per Dozen, Total Costs Per Dozen, and Pearson's Correlation Coefficients

Eggs Produced Per Hen	Percentage of Flocks	Feed Per Dozen	Feed Costs Per Dozen	Total Costs Per Dozen
Under 200	9.8	4.7 lbs.	36.6¢	66.1¢
200 to 219	21.3	4.9	34.2	63.6
220 to 239	29.5	4.5	30.3	55.0
240 to 259	24.6	3.8	29.2	53.1
260 & over	14.8	4.1	28.5	51.8
Correlation Coef.		-0.52**	-0.34**	-0.49**

\*\*Significant (P<.01)

One of the most important aspects often associated with increasing numbers of eggs produced per hen is a reduction in the pounds of feed required to produce a dozen eggs. This is clearly demonstrated in Table 4. As the number of eggs produced per hen increased, the pounds of feed required to produce a dozen eggs decreased such that a highly significant correlation of -.52 was observed. Decreasing feed usage per dozen also reduced feed costs per dozen as well as total costs for each dozen eggs sold. Those farms averaging under 220 eggs produced per hen used almost one pound of feed more per dozen than those averaging over 240 eggs per hen. This added almost 10 cents a dozen to the cost of producing eggs on those farms with fewer than 220 eggs produced per hen.

Table 5. Number of Eggs Produced Per Hen as Related to Net Egg Income Per Dozen, Income Per Hen, Total Labor Costs Per Dozen, Income Per Operator, and Pearson's Correlation Coefficients

Eggs Produced Per Hen	Net Egg Income Per Dozen	Income Per Hen	Total Labor Costs Per Operator	Income Per Operator
Under 200	-2.7	\$-0.28	8.2¢	\$-1,962
200 to 219	-1.0	0.56	8.0	4,316
220 to 239	2.4	0.70	6.2	15,350
240 to 259	2.7	0.77	4.7	43,395
260 & over	4.4	1.37	5.4	19,299
Correlation Coef.	0.25*	0.28*	-0.33**	0.23*

\*Significant (P<.05)

\*\*Significant (P<.01)

Positive relationships between the numbers of eggs produced per hen and net egg income per dozen, income per hen and income per operator were also present. Those flocks averaging less than 220 eggs produced per hen had negative average net egg incomes per dozen while those averaging better than 220 eggs had positive returns per dozen. Labor costs were lowest for those flocks with egg production figures greater than 220 eggs per hen. The highest income per hen and income per operator figures were seen with the highest production flocks.

Pounds of feed per dozen eggs produced and selected variables

Feed represents the major cost item in the production of eggs, accounting for over 50% of the total costs on most New York farms. It is an expense item that deserves considerable attention on the farm. The effect of egg production per hen on feed conversion figures are shown in Table 4. Table 6 presents the relationships between feed conversion and feed costs per dozen, total costs per dozen and income per operator.

Table 6. Pounds of Feed Per Dozen Eggs Produced as Related to Feed Costs Per Dozen, Total Costs Per Dozen, Income Per Hen, Income Per Operator, and Pearson's Correlation Coefficients

Pounds of Feed Per Dozen	Percentage of Flocks	Feed Costs Per Dozen	Total Costs Per Dozen	Income Per Hen	Income Per Operator
Under 4.00	24.6	28.7¢	50.6¢	\$1.29	\$36,901
4.00 to 4.49	29.5	30.5	51.5	.63	20,921
4.50 to 4.99	27.9	33.1	62.4	.54	7,298
5.00 & over	18.0	36.0	62.3	.79	8,279
Correl. Coef.		0.52**	0.47**	-0.17	-0.25*

\*Significant (P<.05)

\*\*Significant (P<.01)

Again, the importance of feed conversion to important cost and income factors is demonstrated. Nearly 25% of the flocks averaged less than 4.0 pounds of feed per dozen eggs produced. As a result, these farms had the lowest feed costs and lowest total costs per dozen and showed the highest incomes per hen and per operator.

Birds per cage and square inches per bird

Information on the number of birds housed per cage and cage area provided for each bird was not available until 1977. Therefore, information relating to these two variables was available from only 33 flocks. Due to the small sample size, none of the correlations involving these two traits were statistically significant (Table 15).

ANALYSIS OF BUSINESS MANAGEMENT VARIABLES

Business management variables examined were; labor and management income per operator, percentage eggs marketed wholesale, percentage eggs marketed premium, price received per dozen eggs sold, average farm inventory, total labor costs per dozens eggs sold, total costs per dozen eggs sold, net egg income per dozen eggs sold, income per hen, feed cost per hundred weight, feed costs per dozen eggs produced; and investment per hen. The average values for these variables are presented by years in Table 7.

Table 7. Yearly Averages for Business Management Variables, and Pearson's Correlation Coefficients

Variable	Year					Avg.	Correl. Coef.
	75	76	77	78	79		
Income/Operator (\$)	6,472	12,423	32,963	10,758	28,992	18,774	0.17
Eggs Mktd. Wholesale (%)	28.6	38.8	38.4	32.0	39.8	36.0	0.07
Eggs Mktd. Premium (%)	71.4	61.2	61.6	68.0	60.2	64.0	-0.07
Price/Dozen (¢)	57.7	62.0	54.4	54.2	61.3	58.4	0.02
Ave. Inventory (\$)	178,825	189,931	257,517	232,021	469,431	266,039	0.28*
Total Labor Costs/ Doz. (¢)	5.5	7.7	5.4	6.1	6.7	6.3	0.04
Net Egg Income/ Doz. (¢)	-0.8	5.2	0.6	0.0	1.0	1.4	-0.06
Income/Hen (\$)	0.40	0.77	1.08	0.61	0.88	0.75	0.11
Feed Costs/Cwt. (\$)	6.96	7.08	6.99	7.01	8.36	7.30	0.45*
Feed Costs/Doz. (¢)	31.3	34.2	30.6	28.8	32.4	31.8	-0.05
Investment/Hen (\$)	7.50	7.08	7.42	9.28	9.71	8.26	0.36*
Total Costs/Doz. (¢)	58.5	56.8	53.8	54.2	60.3	57.0	0.03

\*Significant (P<.05)

Of the 12 business management variables analyzed, only average inventory, feed costs and investment per hen showed significant linear relationships with time. Average farm inventory showed a significant positive correlation of .28 with years as would be expected with the increased costs of farm supplies and equipment during this period. Investment per hen, being a function of the average inventory, also increased significantly during this five-year period. Feed costs per hundred weight increased from \$6.96 in 1975 to \$8.36 in 1979, however, feed costs per dozen eggs produced did not change significantly from 1975 to 1979. This was a result of improved feed conversion figures and higher egg production records during this time.

Total labor cost and related factors

Labor represents a significant cost factor for most poultry operations. Total labor costs ranged from as low as 1.5 cents per dozen eggs sold on some farms to as high as 18.5¢ per dozen on others. Some of the more significant relationships with labor costs found in this study are presented in Table 8.

Table 8. Labor Costs Per Dozen as Related to Percentage Eggs Sold Wholesale, Total Costs Per Dozen Eggs Sold, Income Per Operator, and Pearson's Correlation Coefficients

Total Labor Costs Per Dozen	Percentage of Flocks	Eggs Sold Wholesale	Total Costs Per Dozen	Income Per Operator
Less than 3.0	13.1	52.0%	47.5¢	\$77,195
3.00 to 5.99	32.8	45.7	54.9	18,048
6.00 to 8.99	36.0	20.0	59.4	7,091
9.0 & over	18.0	29.7	63.2	975
Correl. Coef.		-0.21	0.35**	-0.37**

\*\*Significant (P<.01)

A negative relationship (-0.21) was present for labor costs per dozen and percentage of eggs sold wholesale indicating that as the percentage of eggs marketed wholesale decreased, the labor costs per dozen eggs sold increased. These results are likely the effect of increased labor requirements associated with marketing practices required for non-wholesale distribution. Labor costs, being an integral part of overall costs, were highly correlated (0.35) with total cost. Increasing labor costs resulted in higher total costs per dozen eggs sold. A significant negative correlation of -0.37 was found between total labor costs and income per operator. Those farms with labor costs of less than 6 cents per dozen had much larger labor and management incomes.

Feed costs per dozen and related factors

Tables 2, 4 and 6 provided information on the number of layers, eggs produced per hen and feed conversion per dozen eggs produced and their association with feed costs per dozen. Table 9 demonstrates the relationships found for feed costs per dozen and some of the associated business management variables.

Table 9. Feed Costs Per Dozen as Related to Investment Per Hen, Income Per Dozen, Total Costs Per Dozen Eggs Sold, Income Per Operator, and Pearson's Correlation Coefficients

Feed Costs Per Dozen	Percentage of Flocks	Investment Per Hen	Price Per Dozen	Total Costs Per Dozen	Income Per Operator
Less than 30.0¢	36.1	\$8.47	54.5¢	52.1¢	\$32,345
30.0 to 34.9	36.1	9.56	59.3	58.4	12,043
35.0 to 39.9	24.5	9.34	61.9	60.7	11,029
40.0 & over	3.3	15.09	63.5	68.8	1,641
Correl. Coef.		0.22	0.48**	0.45**	-0.24

\*\*Significant (P<.01)

Over 72% of the flocks in this study averaged less than 35¢ a dozen for feed costs during this period. These flocks also showed the lowest investment costs per hen, lowest incomes per dozen, lowest total costs per dozen eggs sold and the highest incomes per operator. Feed costs per dozen has already been shown to be highly correlated (-.34) with flock size (Table 2) while Table 3 presented the negative relationship between flock size and price received per dozen and the positive relationship between flock size and income per operator. Thus the relationships shown in Table 9 can be explained as a result of the combination of effects produced by flock size and feed conversions per dozen. Larger flocks had lower investment costs per hen, received lower prices per dozen eggs sold, achieved better feed conversion and had higher incomes per operator.

Total costs per dozen and related factors

Many factors contribute to the overall costs for each dozen eggs sold. Some of the more important relationships found in this study are presented in Tables 10 and 11.

Table 10. Total Costs Per Dozen Eggs Sold as Related to Percentage Eggs Marketed Wholesale, Feed Costs Per Dozen, Labor Costs Per Dozen, and Pearson's Correlation Coefficients

Total Costs Per Dozen	Percentage of Flocks	Eggs Marketed Wholesale	Feed Costs Per Dozen	Total Labor Costs Per Dozen
Less than 50¢	19.6	67.5%	28.1¢	4.4¢
50.0 to 54.9	22.9	52.1	31.3	6.0
55.0 to 59.9	16.4	27.4	33.1	5.5
60.0 & over	41.0	15.3	33.3	7.7
Correl. Coef.		-0.50**	0.45**	0.35**

\*\*Significant (P<.01)

Flocks with total costs of less than 50¢ per dozen eggs sold marketed a greater percentage of eggs wholesale, had lower feed costs per dozen eggs produced and had lower labor costs per dozen eggs sold than those with costs greater than 50¢. It is evident from Table 10 that feed costs and labor costs per dozen contributed significantly to the total costs per dozen eggs sold in these flocks. Those flocks with total costs per dozen over 60¢ averaged 5.2¢ per dozen greater feed costs and 3.3¢ per dozen higher labor costs than those flocks having total costs per dozen less than 50¢.

Table 11. Total Costs Per Dozen Eggs Sold as Related to Price Per Dozen, Income Per Hen, Net Egg Income Per Dozen, Income Per Operator, and Pearson's Correlation Coefficients

Total Costs Per Dozen	Price Per Dozen	Income Per Hen	Net Egg Income Per Dozen	Income Per Operator
Less than 50¢	50.8¢	\$1.10	7.5¢	\$59,189
50.0 to 54.9	56.8	0.88	3.8	16,507
55.0 to 59.9	58.9	1.23	-1.4	17,857
60.0 & over	62.6	0.24	-2.6	1,013
Correl. Coef.	0.64**	-0.30**	-0.65**	-0.41**

\*\*Significant (P<.01)

Total costs per dozen eggs sold were positively associated with price received per dozen eggs sold (Table 11). This was due to the fact that those flocks with greater total costs marketed a higher percentage of eggs at premium prices. Income per hen was negatively associated (-.30) with total costs per dozen as was income per operator (-.41) and net egg income (-.65). Those flocks averaging less than 55¢ per dozen total cost had positive net egg incomes per dozen.

Price per dozen and related factors

Price received for the product sold is an important factor that relates to the marketing program used on individual farms. The relationship between the price received per dozen eggs sold and the percentage of eggs marketed by wholesale and premium methods are demonstrated in Table 12.

Table 12. Price Per Dozen Eggs Sold as Related to Percentage Eggs Sold Wholesale, Percentage Eggs Sold Premium, and Pearson's Correlation Coefficients

Price Per Dozen	Percentage of Flocks	Eggs Marketed Wholesale	Eggs Marketed Premium
Under 49.9¢	9.8	98.5%	1.5%
50.0 to 54.9	23.6	56.3	43.7
55.0 to 59.9	28.9	16.6	83.4
60.0 & over	37.7	23.3	76.7
Correl. Coef.		-0.53**	0.53**

\*\*Significant (P<.01)

The relationship between gross income per dozen eggs sold and eggs marketed wholesale and premium is clearly evident from Table 12. As the percentage of eggs sold through premium markets increased, the price received per dozen increased. The lack of a significant correlation between marketing practices and net egg income per dozen (Table 15) suggests that profit margins for egg sales are more closely associated with total costs than with the marketing method chosen (i.e., net returns from egg sales are as likely to be positive on farms with wholesale distribution as those with premium marketing if costs are controlled).

Net egg income per dozen and related factors

Net egg income per dozen eggs sold represents the amount of income associated with egg sales after all production and marketing costs are removed. It is an important factor for profit and loss figures at the end of the year

as well as from a positive cash flow standpoint during the production cycle. Net egg income per dozen eggs sold and some of the important relationships found in this study are presented in Table 13.

Table 13. Net Egg Income Per Dozen Eggs Sold as Related to Labor Costs Per Dozen, Total Costs Per Dozen Eggs Sold, Income Per Hen, and Pearson's Correlation Coefficients

Net Egg Income Per Dozen	Percentage of Farms	Total Labor Costs Per Dozen	Total Costs Per Dozen	Income Per Hen
Less than -5.0¢	16.4	7.6¢	66.8¢	\$-0.19
-5.0 to -0.1	24.5	6.9	60.2	0.32
0.0 to 4.9	37.8	5.2	54.7	1.03
5.0 & over	21.3	6.7	49.8	1.37
Correl. Coef.		0.22	-0.65**	0.49**

\*\*Significant (P<.01)

Of the 61 flocks analyzed, 40.9% had negative net egg incomes related to egg sales. These flocks also had higher labor costs per dozen eggs sold and higher total costs per dozen eggs sold than those flocks having positive net egg incomes per dozen. Income per hen was greatest for those flocks with the better net egg income figures.

#### Income per operator and related factors

The most commonly used measure of success by farm businessmen is the labor and management income per operator. This figures represents the net dollar income to the farm operator for his operation of the farm.

Over 70% of the flocks had labor and management incomes per operator of less than \$20,000. The flocks with the highest incomes per operator had the lowest feed costs per dozen eggs produced and the lowest total costs per dozen eggs sold. A highly significant positive correlation of .76 was found between income per operator and average annual inventory indicating that much of the income per operator reported during this 5-year program was related to farm size and explains the relationship demonstrated showing negative net egg incomes per dozen eggs sold, but positive incomes per hen per operator. The low positive relationship of 0.27 for net egg income per dozen with incomes per operator and the high positive correlation of .76 between income per operator and average annual inventory indicates size of operation to be more closely related to income per operator figures than net egg income from egg sales. This suggests that for many of the farms a substantial amount of income has been related to increases in the farm inventory situation during the year.

Table 14. Income Per Operator and Feed Costs Per Dozen, Total Costs Per Dozen, Income Per Hen, Average Inventory, and Pearson's Correlation Coefficients

Income Per Operator	Percentage of Flocks	Feed Costs Per Dozen	Total Costs Per Dozen	Net Egg Income Per Dozen	Income Per Hen	Average Inventory
Less than \$0.0	21.3	31.6¢	60.6¢	-1.0¢	-\$0.45	\$248,724
1.00 to 9,999	31.1	35.0	61.3	-0.2	0.67	149,882
10,000 to 19,999	18.0	30.6	57.6	0.6	0.73	237,654
20,000 to 29,999	11.5	31.6	49.4	6.5	1.60	248,399
30,000 to 39,999	9.8	29.1	50.1	4.6	1.34	280,976
40,000 & over	8.3	30.1	48.9	6.1	1.93	821,671
Correl. Coef.		0.24	-0.49**	0.27**	0.38**	0.76**

\*\*Significant (P<.01)

#### MULTIPLE REGRESSION ANALYSIS

In the preceding sections, interpretation of the data was based on relationships quantified by a Pearson correlation analysis. This type of analysis demonstrates the degree to which a straight line relationship exists between two factors. In reality, the true relationships between variables includes the effects of many variables interacting simultaneously. Multiple regression analysis is a procedure which attempts to determine to what extent independent variables affect a dependent variable. Therefore, multiple regression analysis was applied to the factors measured to determine to what extent the variables were affecting the dependent variable of income per operator.

Labor and management income per operator was regressed simultaneously on the 16 independent variables (Table 16). These 16 independent variables combined had a multiple correlation coefficient ( $R^2$ ) of .85, which is equivalent to saying that 85% of the variability of income per operator was due to the influence of the 16 independent variables measured. This also indicates that 15% of the variability for income per operator was unaccounted for by the variables used in the model.

Table 16. Multiple Correlation Coefficients ( $R^2$ ) for Various Combinations of Independent Variables Measured with Income Per Operator as the Dependent Variable

Regression of Income Per Operator on:	$R^2$
INVENT	.59**
INVENT + INC/HN	.81**
INVENT + INC/HN + INV/HN	.84**
ALL REMAINING VARIABLES	.85**

\*\* (P<.01)



The three variables having the greatest effect on income per operator were, average annual inventory, income per hen and investment per hen. Of these three, average annual inventory had the greatest effect on labor and management income per operator accounting for 59% of the variability.

This variable is an indicator of size of operations and demonstrates that larger operations had larger volumes and larger increases in inventories. Over a five-year period it would be expected that these factors would contribute significantly to a greater income situation.

Income per hen was the next most important factor accounting for 22% of the variability. Income per hen is a combination of incomes from egg sales and increases in annual inventories and thus it contributes significantly to management and labor income.

Investment per hen is a measure of capital efficiency for poultry farms and was the third most significant variable relating to labor and management income per operator.

These results indicate that increasing farm size and gross income per hen while decreasing investment costs per hen represent the combination of management factors having the greatest influence on net labor and management incomes per operator. All other factors relative to these three had only minor effects on farm incomes per operator. This would imply that if these three factors are not at optimum levels changes in other management factors will not significantly improve the income situation.

Farm inventory, which represents land, buildings, equipment, livestock, feed and equipment, can be increased by obtainment of additional assets or through appreciation of existing assets. Increases in inventory during the year are added to cash receipts as additional income. It is apparent from the Pearson correlation analysis and the multiple regression analysis that increasing the farm inventory has been an important factor for the income figures reported in this study.

Income per hen also contributed significantly to the variability of income per operator. This factor was highly correlated (.49) with net egg income per dozen and thus increasing the gross income per hen also resulted in increased margins of profit per dozen as well as being positively correlated (.28) with eggs produced per hen.

Investment per hen contributed 3% to the variability of income per operator and indicates that decreasing investment costs per hen improves net returns.

Table 17 presents a summary of the variables measured for the sixty-one flock records analyzed during this five-year period. A large range existed in the size of operations reporting during this study. The smallest farm reporting had 1600 layers while the largest reported over a quarter of a million. It is likely that the 61 records evaluated represent a fair cross section of the types of poultry operations and management programs currently in operation in New York.

Table 17. Summary of the Variables Measured for the Sixty-one Flock Records Analyzed

Variable	Average	Minimum	Maximum
Layers	32,187	1600	258,333
Eggs Marketed Wholesale (%)	36	0.0	100
Eggs Marketed Premium (%)	64	0.0	100
Income/Dozen (¢)	58.4	43.5	80.9
Feed Costs/cwt (\$)	7.30	5.47	9.99
Annual Inventory (\$)	266,039	10,000	2,465,000
Total Labor Cost/Dozen (¢)	6.3	1.5	18.5
Total Costs/Dozen (¢)	58.39	32.9	76.7
Income/Operator (\$)	18,774	-44,473	252,690
Income/Hen (\$)	0.75	-1.49	4.40
Eggs Produced/Hen	232	176	297
Pounds of Feed/Dozen	4.4	3.2	5.8
Feed Costs/Dozen (¢)	31.7	19.5	48.8
Investment/Hen (\$)	9.45	1.54	19.98
Net Egg Income/Dozen (¢)	-.02	-9.7	28.2

#### SUMMARY

The purpose of this study was to statistically determine the effects of certain poultry farm management factors obtained from the 1975-1979 poultry farm business summaries upon labor and management income per operator. Data from a total of sixty-one flock records during this five-year period were used in this project. Farms reporting poultry as the only income enterprise were used in this analysis so as not to introduce the effects of other commodity incomes on the results. By use of computer it was possible to sort the data and perform Pearson correlation and multiple regression analysis.

Five production variables were quantified and evaluated for their relationship with the other variables measured. Of these, numbers of layers, eggs per hen and pounds of feed per dozen eggs produced demonstrated significant relationships. In general, the larger farms had lower feed costs, better feed conversion figures, lower feed costs per dozen and greater incomes per operator. Egg production was positively associated with net egg incomes per dozen and

income per operator while pounds of feed per dozen eggs produced was negatively associated with income per hen and income per operator.

Evaluation of the 12 business management factors produced numerous significant associations. It was found that feed costs per dozen and labor costs per dozen contributed significantly to the total costs per dozen eggs sold. Total costs per dozen eggs sold were significantly related to net egg income per dozen as well as income per operator. It was evident from the data that reducing production costs resulted in improved income situations for many flocks. Net egg income per dozen was significantly correlated with labor costs per dozen, total costs per dozen and income per hen. The flock records with the highest incomes per operator also had the lowest total costs per dozen eggs sold. Significant positive correlations (.76 and .72) were found between income per operator and size of operation as reflected in average annual inventory and layer numbers. This relationship in conjunction with a significant relationship (.27) between net egg income per dozen and income per operator indicated size of operation to be more closely related to income per operator than net egg income figures for egg sales.

Multiple regression analysis identified farm size, income per hen and investment per hen to be the factors having the greatest influence on income per operator in this study.